

Phreatic eruptions at Ruapehu: Occurrence statistics and probabilistic hazard forecast

Phreatic eruptions, although posing a serious threat to people in crater proximity, are often underestimated and have been comparatively understudied. The detailed eruption catalogue for Ruapehu Volcano (New Zealand) provides an exceptional opportunity to study the statistics of recurring phreatic explosions at a crater lake volcano. We performed a statistical analysis on this phreatic eruption database, which suggests that phreatic events at Ruapehu do not follow a Poisson process. Instead they tend to cluster, which is possibly linked to an increased heat flow during periods of a more shallow-seated magma column. The averaged, absolute probability for a phreatic explosion to occur at Ruapehu within the next month is about 10%. However, the frequency of phreatic explosions is significantly higher than the background level in years prior to magmatic episodes.

Combining clast ejection simulations with a Bayesian event tree tool (PyBetVH) we perform a probabilistic assessment of the hazard due to ballistic ejecta in the summit area of Ruapehu, which is frequently visited by hikers. Resulting hazard maps show that the absolute probability for the summit to be affected by ballistics within the next month is up to 6%. The hazard is especially high on the northern lakeshore, where there is a mountain refuge.

Our results contribute to the local hazard assessment as well as the general perception of hazards due to steam-driven explosions.